

## SAUDI ARABIAN OIL COMPANY

<b>REVISION CERTIFICATE</b> THIS INDICATES THAT REV. NO. ____ OF2 OF THIS DRAWING IS COVERED, FOR ALL APPROVAL/CERTIFICATION REQUIREMENTS, BY DRAWING COMPLETION CERTIFICATE (DOC) NO. _____	EDSD VERIFICATION	OPERATIONS	DATE: _____	CONSTRUCTION AGENCY	DATE: _____	CERTIFIED	DATE: 10-Sep-23	K. OGAWA	PROJECT ENGINEER	DATE: 10-Sep-23	T. MINE	DISCIPLINE ENGINEER	DATE: 10-Sep-23	S. SASAKI	REV.	DATE	JO / EWO	DESCRIPTION	ENGG	CERT	PMT	OPRNS
																		ISSUED FOR CONSTRUCTION	S.S	K.O	T.M	
																		ISSUED FOR CONSTRUCTION	S.S	K.O	T.M	
																		ISSUED FOR CONSTRUCTION	S.S	K.O	T.M	

# MECHANICAL DATA SHEET FOR LOW PRESSURE PRODUCTION TRAP LPPT A81-D-0001 A82-D-0001

JGC JOB NO.	0-8887-20-0000	
JGC DOC. NO.	SD-8100-13513-0001	
UNIT	8100	
ISSUE PURPOSE	FOR CONSTRUCTION	
PREP'D	CHK'D	APP'D
E.P	G.E	S.S
JGC CORPORATION		

MECHANICAL DATA SHEET FOR LOW PRESSURE PRODUCTION TRAP LPPT (A81-D-0001, A82-D-0001)	DWG TYPE	PLANT NO.	INDEX	DRAWING NO.	SHT NO.	REV NO.
ZULUF ONSHORE OIL FACILITIES	DAT	A81	D	CD-553416-001	1 OF 5	0F2
ZAFANIYA	SAUDI ARABIA	JO / EWO	10-08643-0005			

SEE GENERAL ARRANGEMENT DRAWING ON SHEET 3 and 4 OF 5

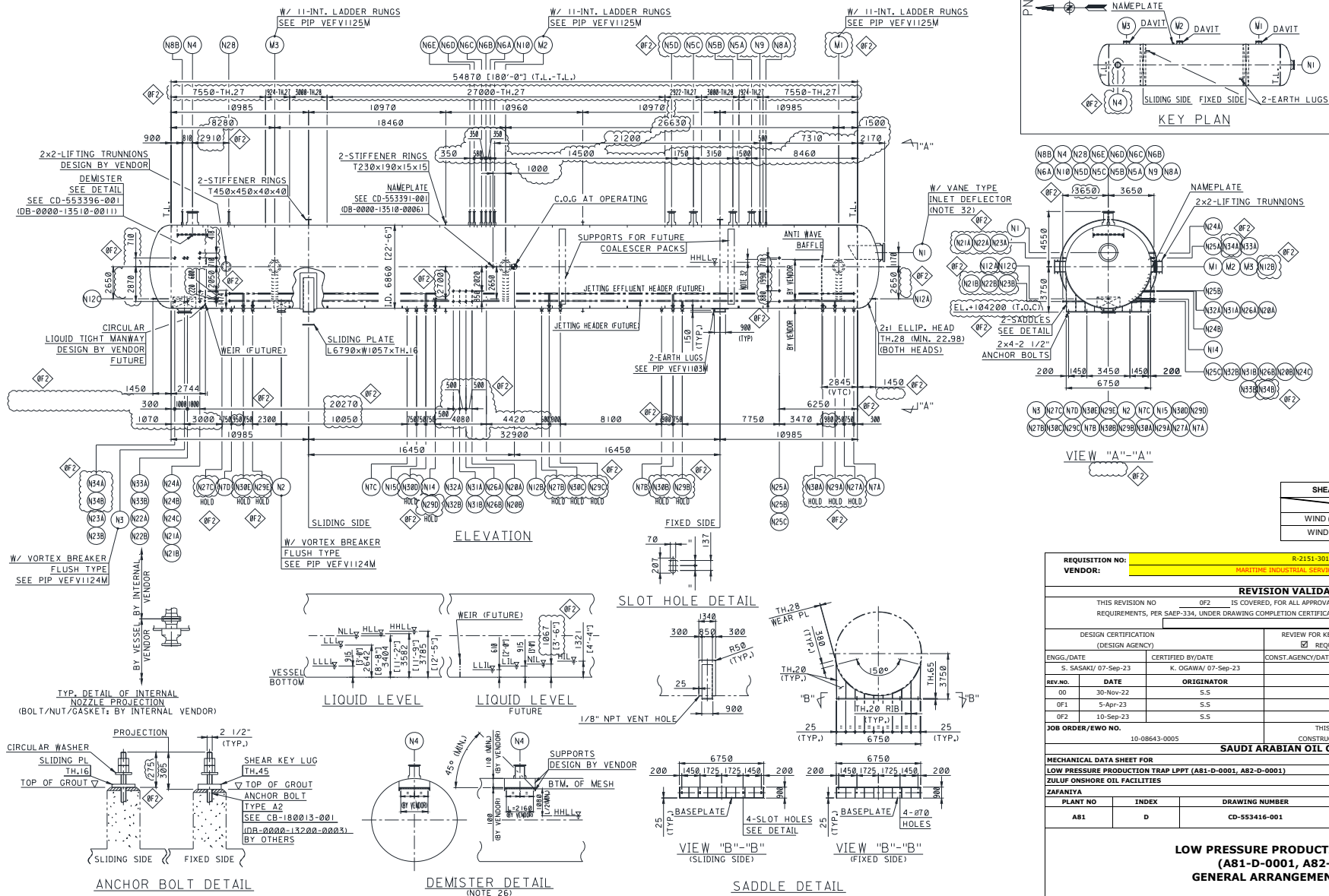
TWO (2) QUANTITY IS REQUIRED: A81-D-0001 & A82-D-0001

NOZZLE & MANWAY SCHEDULE						
MARK	QTY	SIZE	SERVICE	ASME CLASS	FACE TO CL. (mm)	REMARKS
N1	1	48"	FEED	150# RFSRWN	SEE DWG	B16.47 SERIES A
N2	1	20"	WATER OUT	150# RFSRWN	3760	
N3	1	36"	EMULSION OUTLET	150# RFSRWN	3820	B16.47 SERIES A
N4	1	30"	VAPOR OUTLET	150# RFSRWN	SEE DWG	B16.47 SERIES A
N5 A/B/C/D	6	16"	P2V	150# RFSRWN	SEE DWG	
N6A/B/C/D/E	5	3"	PR. TRANSMITTER	300# RFSRWN	SEE DWG	
N7 A/B/C/D	4	4"	CLOSED DRAIN	150# RFSRWN	3670	
N8 A/B	2	2"	VENT LINE	150# RFLWN	SEE DWG	
N9	1	3"	VENT TO FLARE	150# RFSRWN	SEE DWG	
N10	1	4"	VENT LINE	150# RFSRWN	SEE DWG	
N12 A/B/C	3	2"	STEAM OUT	150# RFLWN	SEE DWG	
N14	1	6"	FUTURE PUMP RECYCLE	300# 150# RFSRWN	SEE DWG	
N15	1	3"	ANODE MONITORING	150# RFSRWN	3670	NOTE 56, W/ BLIND FLANGE
N20 A/B	2	3"	LEVEL TRANSMITTER (FUTURE)	300# RFSRWN	SEE DWG	
N21 A/B	2	3"	LEVEL TRANSMITTER	300# RFSRWN	SEE DWG	
N22 A/B	2	3"	LEVEL TRANSMITTER	300# RFSRWN	SEE DWG	
N23 A/B	2	3"	LEVEL TRANSMITTER	300# RFSRWN	SEE DWG	
N24 A/B/C	3	3"	LEVEL TRANSMITTER	300# RFSRWN	SEE DWG	
N25 A/B/C	3	2"	INTERFACE LEVEL / LEVEL TRANSMITTER	300# RFLWN	SEE DWG	
N26 A/B	2	3"	SPARE	300# RFSRWN	SEE DWG	W/ BLIND FLANGE
N27 A/B/C	3	3"	ANODE MONITORING	150# RFSRWN	3670	NOTE 56, W/ BLIND FLANGE
N28	1	3"	PDIT	300# RFSRWN	SEE DWG	
N29A/B/C/D/E	5	4"	JETTING NOZZLES	150# RFSRWN	3670	NOTE 56
N30A/B/C/D/E	5	4"	JETTING EFFLUENT NOZZLES	150# RFSRWN	3670	NOTE 56
N31A/B	2	3"	LEVEL TRANSMITTER (FUTURE)	300# RFSRWN	SEE DWG	with blind flange for N31A/B and N32A/B
N32A/B	2	3"	LEVEL TRANSMITTER (FUTURE)	300# RFSRWN	SEE DWG	
N33A/B	2	3"	LEVEL TRANSMITTER	300# RFSRWN	SEE DWG	
N34A/B	2	3"	LEVEL TRANSMITTER	300# RFSRWN	SEE DWG	
M1/2/3	3	30"	MANWAY	150# RFSRWN	3770	B16.47 SERIES A, W/ BLIND FLANGE & DAVIT

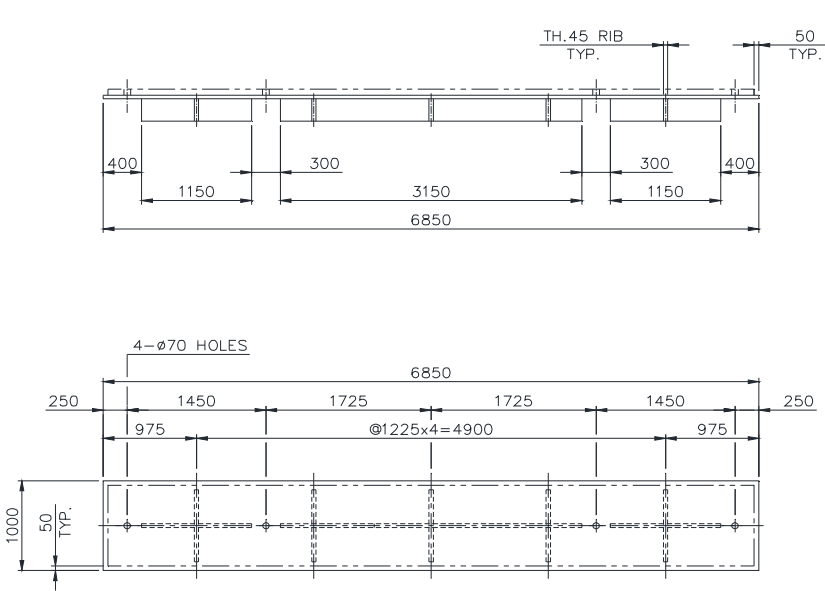
OPERATING CONDITIONS				MATERIALS OF CONSTRUCTION (Note 19)		INSULATION FIREPROOFING & PAINTING	
INTERNAL PRESSURE:	NORMAL:	50 (344.74)	psig(kPag)	COMPONENT:	ASME NO:	INSULATION THICKNESS:	N/A
	MAXIMUM:	90 (620.53)	psig(kPag)	SHELL:		FIREPROOFING THICKNESS:	N/A
EXTERNAL PRESSURE:	NORMAL:		psi(kPa)	- BASE MATERIAL	SA 516 Gr. 70N HIC	SHOP PRIME & PAINT:	(Note 3)
	MAXIMUM:		psi(kPa)	- CLADDING OR OVERLAY	N/A	(SAPCS NO):	N/A
SERVICE: (Note 55)				BOOT:		FIELD PRIME & PAINT:	N/A
If other (Specify):				- BASE MATERIAL	N/A	(SAPCS NO):	N/A
				- CLADDING OR OVERLAY	N/A	ESTIMATED VESSEL WEIGHTS:	
TEMPERATURE:	NORMAL:	92 (33.33)	°F (°C)	HEADS:		SHIPPING:	349,000 kg
	MAXIMUM:		°F (°C)	- TYPE	2:1 ELLIPSOIDAL	EMPTY:	444,000 kg
SPECIFIC GRAVITY OF LIQUID: HEAVY PHASE:1, LIGHT PHASE: 0.87				- BASE MATERIAL	SA 516 Gr. 70N HIC	OPERATING:	1,712,000 kg
DATA SHEET TO BE COMPLETED IN ACCORDANCE WITH SAES-D-001.				- CLADDING OR OVERLAY	N/A	TEST:	2,560,000 kg
VESSELS TO BE MANUFACTURED IN ACCORDANCE WITH 32-SAMSS-004 & 01-SAMSS-016				FLANGES:	SA 350 Gr. LF2 CL1	ACCESSORIES/ATTACHMENTS	
AND APPLICABLE ADDENDUM.				NOZZLE NECK (PIPE/PLATE/FORGE):	SA 106 Gr.8N (SEAMLESS)/ SA 516 Gr.70N HIC / SA 350 Gr. LF2 CL-1		
DESIGN CONDITIONS				INTERNAL ATTACHMENT CLIPS:	SA 516 Gr. 70N HIC	INLET DEVICE:	YES
ASME DESIGN CODE & EDITION:	ASME SEC. VIII DIV. 1, 2021 ED. + U STAMP			EXTERNAL ATTACHMENT CLIPS:	SA 516 Gr. 70N	CP ANODES BRACKET/CLIPS:	YES
INTERNAL PRESSURE:	110 (758.42)	psig(kPag)		STUD BOLTS:	SA-193 Gr. 87M	SLIDING ASSEMBLY:	YES
EXTERNAL PRESSURE/TEMPERATURE:	7.5 (51.71) @ 300 (148.89) (Steam Out) (Note 52)	psi(kPa)/°F (°C)		NUTS:	SA-194 Gr. 2HM	PLATFORM & LADDER CLIPS:	YES
INTERNAL TEMPERATURE:	200 (93.33)	°F (°C)		INTERNALS (DEMISTER & REMOVABLE):	S31803	INSULATION SUPPORTS:	N/A
M.D.M.T.:	34 (1.11)	°F (°C)		SUPPORT (SADDLE & PAD):	SA 516 Gr. 70N	FIREPROOFING SUPPORTS:	N/A
REINFORCEMENT:	Integrally reinforced openings			SLIDING PLATE:	SA 36	SADDLE STIFFENERS:	AS REQUIRED
WIND:	PER SP-0000-13100-0002			BOLTS/NUTS (INTERNAL):	S31803	NAMEPLATE W/ BRACKET:	YES
EARTHQUAKE:	PER SP-0000-13100-0001			FITTINGS (EXTERNAL):	N/A	GALVANIC ANODES:	YES
				GASKETS: (Note 4)		VORTEX BREAKER:	YES
				LIFTING LUGS/TRUNNIONS:	SA 516 Gr. 70N	LIFTING LUGS/TRUNNIONS:	YES
				ANCHOR BOLTS (BY OTHERS):	F1554 Gr. 36	GROUNDING LUGS:	YES
CORROSION ALLOWANCE:	0.126 (3.2)	in (mm)		NAMEPLATE/BRACKET:	304 SS / SA 516 Gr. 70N	WEIR:	YES
RADIOGRAPHY:	PER CODE			GROUNDING LUGS:	304 SS	PIPING SUPPORT W/CLIPS:	AS REQUIRED
IMPACT TESTING (IT):	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	<input type="checkbox"/> CODE		VORTEX BREAKER:	SA 516 Gr. 70N HIC	MANWAY LADDER RUNGS:	YES
PWHT:	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/> CODE <input checked="" type="checkbox"/> SERVICE		ANTI WAVE BAFFLES:	SA 516 Gr. 70N HIC	VACUUM STIFFENER RINGS:	AS REQUIRED
I. T. TEMPERATURE:	PER CODE / 32-SAMSS-004			COALESCER PACKS/WEIRS (FUTURE):	S31803 / SA 516 Gr. 70N HIC	BAFFLES SUPPORTS:	YES
I. T. ENERGY AVE./MIN:	PER CODE / 32-SAMSS-004			HEADERS SUPPORT CLIPS (FUTURE):			YES

It is the responsibility of the contractor to ensure filling of this data sheet in compliance to the detailed company standard and material specifications

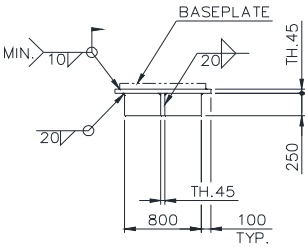
REQUISITION NO:		R-2151-301-C	
VENDOR:		MARITIME INDUSTRIAL SERVICES ARABIA CO. LTD	
REVISION VALIDATION			
THIS REVISION NO 0F2 IS COVERED, FOR ALL APPROVAL AND CERTIFICATION REQUIREMENTS, PER SAEP-334, UNDER DRAWING COMPLETION CERTIFICATION NO:			
DESIGN CERTIFICATION (DESIGN AGENCY)		REVIEW FOR KEY DRAWINGS <input checked="" type="checkbox"/> REQUIRED (SAUDI ARAMCO)	
OTHER			
ENGG./DATE	CERTIFIED BY/DATE	CONST.AGENCY/DATE	OPERATION/DATE
S. SASAKI/ 07-Sep-23	K. OGAWA/ 07-Sep-23		
REV.NO.	DATE	ORIGINATOR	REVISION DESCRIPTION
00	30-Nov-22	S.S	ISSUED FOR CONSTRUCTION
0F1	5-Apr-23	S.S	ISSUED FOR CONSTRUCTION
0F2	10-Sep-23	S.S	ISSUED FOR CONSTRUCTION
JOB ORDER/EWO NO.		THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNTIL CERTIFIED AND DATED	
10-08643-0005			
SAUDI ARABIAN OIL COMPANY			
MECHANICAL DATA SHEET FOR		DRAWING TYPE:	
LOW PRESSURE PRODUCTION TRAP LPPT (A81-D-0001, A82-D-0001)		DAT	
ZULUF ONSHORE OIL FACILITIES			
SAUDI ARABIA			
PLANT NO	INDEX	DRAWING NUMBER	SHT. NO.
A81	D	CD-553416-001	2 of 5
		REV. NO.	
		0F2	
LOW PRESSURE PRODUCTION TRAP LPPT (A81-D-0001, A82-D-0001)			



**LOW PRESSURE PRODUCTION TRAP LPPT**  
**(A81-D-0001, A82-D-0001)**  
**GENERAL ARRANGEMENT DRAWING**



DETAIL OF SHEAR KEY LUG  
(TO BE EMBEDDED IN THE FOUNDATION)  
(FOR FIXED SIDE ONLY)



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CONST.AGENCY/DATE		OPERATION/DATE	
BY/DATE		OTHER	
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LOW PRESSURE PRODUCTION TRAP LPPT (A81-D-0001, A82-D-0001)		DAT	
ZULUF ONSHORE OIL FACILITIES			
SAUDI ARABIA			
ZAFANIYA			
PLANT NO	INDEX	DRAWING NUMBER	SHT. NO.
A81	D	CD-553416-001	4 of 5
REV. NO.			
0F2			
LOW PRESSURE PRODUCTION TRAP LPPT (A81-D-0001, A82-D-0001) DETAIL DRAWING			

NOTES :

- 1 The vendor is responsible for the equipment design and fabrication.  
Weights and thickness indicated are preliminary and shall be verified by vendor.
- 2 Deleted.
- 3 External painting and internal coating shall be as per SAES-H-001, SAES-H-101V, SS-0000-13A00-0001, and SS-0000-13A00-0003.

Parts	External Painting	Internal Coating
Vessel	APCS-11A	APCS-2E (All wetted CS internal surfaces)
Support	APCS-1D	-
Support under fireproofing	-	-

Vendor is responsible for internal coating application with full time inspection per specification SAES-H-001 and 175-091900 inspection requirements. Surface preparation shall be as recommended coating system. All welds shall be ground flush and sharp edges shall be removed and all corners shall be radiused. Vendor shall confirm suitability of APCS-2E for steam out condition.

- 4 Spiral wound gasket shall have 316 SS winding, graphite filler with 316 SS inner ring and CS outer ring.
- 5 Deleted.
- 6 Deleted.
- 7 Nozzle and manway bolt holes shall straddle vessel centerlines unless otherwise indicated.
- 8 Deleted.
- 9 Vendor shall design and fabricate vessel and lifting attachment for an impact factor of 2.0 min. considering erection weight.
- 10 Deleted.
- 11 All blind nozzles (including anode monitoring nozzle) and manways shall be complete with gasket, bolts and nuts.
- 12 Deleted.
- 13 All removable internals shall be designed and fabricated to pass through manway.
- 14 Deleted.
- 15 Deleted.
- 16 Deleted.
- 17 Deleted.
- 18 Vendor shall provide internal cathodic protection as per SAES-X-500 and AA-036388 / 89.  
All metallic parts/devices installed inside the vessel whose material different from the vessel material shall be isolated from the body of the vessel.  
A way of measuring electrical resistance with a megger tester has to be provided between the body of the vessel and each such internal part/device.
- 19 Equipment is in non-lethal and non-cyclic wet sour service region 2 and shall comply with NACE MR0175/ISO15156 with HIC requirements and NACE RP0472.
- 20 Deleted.
- 21 Deleted.
- 22 Deleted.
- 23 Deleted.
- 24 The LPPT shall be equipped with a submerged weir (for future installation). The weir shall be located at least one vessel diameter from the vessel tangent line on the side of outlet nozzles. The weir shall be supplied with provisions for future extension in height.
- 25 Deleted.
- 26 Demister pad to be fitted at vapour outlet of nozzle N4. Demister pad to be supplied and designed by vendor based on the following requirements (Early stage 2 % water cut summer case):  
1) Bulk density lb/ft3 = 4.99  
2) Vapour density in lb/ft3 = 0.321  
3) Liquid Particle density in lb/ft3 = 53.9  
4) Liquid particle viscosity in cP = 22.0 (Max. 118)  
5) Material of the wire mesh = S31803  
6) Density of the wire mesh (lb/ft3) = by Vendor  
7) Droplet size (micron) = greater than 6 microns  
8) Vapour viscosity in cP = 0.011  
Demister pad to minimize liquid carry over in the gas. Liquid carry over in gas shall be less than 0.1 gal/MMSCF.  
Demister pad sizing and calculation shall be submitted for approval.  
Demister pad and support grids shall be removable to pass through manway.
- 27 Vendor shall perform computational fluid dynamic (CFD) modeling to demonstrate the separation efficiency of the selected vessel internals. CFD analysis shall demonstrate the required product stream specifications are specifications are achieved by the proposed vessel internals based on the process stream data provided.

NOTES (Cont.):

- 28 All internals shall be trial fitted inside the vessel at vendor shop under the supervision of internals manufacturer on a full-time basis during fabrication. Necessary isolation between dissimilar materials (such as carbon steel and stainless steel) shall be maintained which shall be tested using megger testing.
- 29 Bolting for inlet device and supporting frame shall use locknuts or double nuts with tack weld to avoid loosening due to the dynamic loads from the slugs. Bolting arrangement shall be reviewed and concurred by Aramco.
- 30 Vendor shall provide supports for two internal coalescers for future installation. Support shall be suitable for selected coalescer pack meeting performance requirements.
- 31 Perforated (not Slotted) Anti-Wave baffles shall be provided.
- 32 Vendor shall mechanically design the process vane type inlet deflector device considering the inlet nozzle fluid force to be pu2: 3806 lb/(ft-s<sup>2</sup>) and confirm the size of the Feed Inlet Nozzle (N1).  
The inlet nozzle shall be 6" (min.) above high high liquid level (HHLL) to avoid liquid re-entrainment.

- 33 Deleted.
- 34 Deleted.
- 35 Deleted.
- 36 Turn down flow rate is 40%.
- 37 LPPT process stream properties:

Parameters	Units	Summer 36%	Winter 36%
Operating Pressure	psig	50	50
Operating Temperature	°F	92.1	59.3
Gas Feed Flow	lb/hr	238000	209600
Gas Density	lb/ft3	0.271	0.270
Gas Viscosity	cP	0.011	0.011
Oil Feed Flow	lb/hr	4205000	4244000
Oil Volumetric Flow (actual)	MBPD	329.5	328.2
Oil Density	lb/ft3	54.53	55.24
Oil Viscosity	cP	12.4	17.68
Oil Surface Tension	dynes/cm	24.12	25.05
Water Feed Flow	lb/hr	2732000	2781000
Water Volumetric Flow (actual)	MBPD	186.8	186.2
Water Density	lb/ft3	62.5	63.35
Water Viscosity	cP	0.742	1.13
Water Surface Tension	dynes/cm	70.64	73.79

- 38 Vendor shall provide suitable vessel internals (e.g. coalesce packing) to guarantee adequate separation of oil, gas, and water as per the streams provided in the above table.
- 39 Three phase Production Traps shall be designed to separate oil droplets of 200 microns and larger at Normal Interface Level (NIL) from water continuous phase and have minimum 5 minutes water retention time.
- 40 The nozzles for the interface level instruments shall be located close to the water weir. Whenever possible, the nozzles for the interface level instruments shall not be taken from the bottom of the vessel. However, when used, bottom vessel connections shall include an internal nozzle extension to reduce bottom solids from entering the standpipe.
- 41 The nozzles for the oil level instruments shall be located into the oil collection compartment. Whenever possible, the nozzles for the oil level instruments shall not be taken from the bottom of the vessel. However, when used, bottom vessel connections shall include an internal nozzle extension to reduce bottom solids from entering the standpipe.
- 42 Spare interface level connection shall be installed for future expansion of interface level range.
- 43 Vendor shall recommend control and safety instrumentation for safe operation.
- 44 Level instruments nozzles shall not be located at bottom of the vessel unless necessary.
- 45 Summer 36% water cut and winter 36% water cut are the design basis for vessel sizing and weir overflow design.
- 46 Longitudinal seam of thick stroke at saddles shall be fully radiographed.
- 47 Steam out nozzle and vent shall be as far apart as possible to allow steam sweeping through the vessel.
- 48 Vendor shall provide jetting water system for LPPT to remove solids (for future installation).
- 49 Deleted.
- 50 All dimensions are in millimeters (mm), unless otherwise indicated.
- 51 Deleted.
- 52 Vessel is subject to steam-out condition and shall be designed for an external pressure of 7.5 psi @ 300 °F.
- 53 Deleted.
- 54 Deleted.
- 55 Special Service:  
Lethal: No                      Wet Sour: Yes                      Amine: No                      Cyclic: No  
Caustic: No                      H2: No                      Utility: No

- 56 Nozzle size and quantity to be confirmed by vendor.

Parameters	Units	Value (36% Winter)
Liquid Mass Flow Rate	lb/hr	6933730
Liquid Density	lb/ft3	57.4
Vapor Mass Flow Rate	lb/hr	237887
Vapor Density	lb/ft3	0.271
Density for Slug Force Calc.	lb/ft3	57.4

APPLICABLE SPECIFICATIONS AND STANDARDS

Following specifications, standards and drawings are shall be considered as minimum, but not limited to:

Project Specifications:

- PE-300003                      Specification for Pressure Vessels  
CE-557203-001              Supplementary Specification for Safety Identification and Safety Colors  
(SS-0000-13A00-0002)

Saudi Aramco Materials System Specifications

- 01-SAMSS-016              Qualification of Plates for Pressured Equipment and Storage Tanks and for Resistance to Hydrogen-Induced Cracking  
02-SAMSS-011              Forged Steel and Alloy Flanges  
17-SAMSS-006              Galvanic Anodes for Cathodic Protection  
17-SAMSS-008              Junction Boxes for Cathodic Protection  
32-SAMSS-004              Manufacture of Pressure Vessels

Saudi\_Aramco\_Engineering\_Standards

- SAES-A-112                  Meteorological and Seismic Design Data  
SAES-A-202                  Saudi Aramco Engineering Drawing Preparation  
SAES-A-206                  Positive Material Identification  
SAES-H-001                  Coating Selection and Application Requirements for Industrial Plants and Equipment  
SAES-H-101V                Approved Saudi Aramco Data Sheets – Paints and Coatings  
SAES-J-100                  Process Measurement  
SAES-M-001                  Structural Design Criteria for Non-Building Structures  
SAES-N-001                  Basic Criteria, Industrial Insulation  
SAES-W-010                  Welding Requirements for Pressure Vessels  
SAES-X-500                  Cathodic Protection of Vessel and Tank internals

Standard Drawings

- CD-553389-001              Standard Drawing for Pipe Support Lug  
(DB-0000-13410-0004)  
CD-553391-001              Standard Drawing for Nameplate for Pressure Vessel  
(DB-0000-13510-0006)  
CD-553396-001              Standard Drawing for Wire Mesh Blanket Support- VBR  
(DB-0000-13510-0011)  
CB-180013-001              Foundation Plan/ Layout/ Sect/ Det PJ Standard Anchor Bolt  
(DB-0000-13200-0003)  
VEFV1100M                  Vessel/ S&T Heat Exchanger Standard Details (Metric Units)

REQUISITION NO:	R-2151-301-C
VENDOR:	MARITIME INDUSTRIAL SERVICES ARABIA CO. LTD

REVISION VALIDATION				
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ZULUF ONSHORE OIL FACILITIES				
ZAFANIYA				
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PLANT NO	INDEX	DRAWING NUMBER	SHT. NO.	REV. NO.
A81	D	CD-553416-001	5 of 5	0F2

LOW PRESSURE PRODUCTION TRAP LPPT  
(A81-D-0001, A82-D-0001)  
GENERAL NOTES